DOCUMENT RESUME

ED 235 945 RC 014 378

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TITLE Rural Science Education: Blueprint for All?
PUB DATE Nov 82
NOTE 11p.; Paper presented at the Annual Rural and Small Schools Conference (4th, Manhattan, KS, November 15-16, 1982).
PUB TYPE Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Interpersonal Relationship; Rural Education; *Rural Environment; Rural Schools; Rural Urban Differences; School Size; *Science Education; Science Teachers; Scientific Literacy; Scores; Secondary Education; *Student Attitudes; *Student Teacher Relationship; *Teacher Behavior; *Teaching Methods
IDENTIFIERS National Assessment of Educational Progress

ABSTRACT

Characteristics of the rural school environment may partially account for the stability of rural students' science scores at a time of declining national science scores on the National Assessment of Educational Progress Test. The relative success of rural science students may be tied to the rural student-teacher relationship. Several studies reveal greater interpersonal communication in rural school settings. The success may also stem from student attitudes toward teaching behaviors. According to a survey of the attitudes toward teaching behaviors of students from a variety of demographic areas with urban and rural populations, school size does not affect student perception of desirable science teaching behavior. Rural and urban students are united in their perceptions of those teaching behaviors that indicate quality science teaching. They perceive teachers who are well-prepared to conduct an activity-oriented class with hands-on experience in a nearly natural setting as being high quality teachers. The fact that student success in the classroom is influenced by student perception of the classroom environment, coupled with the fact that student preferences in methodolgical behaviors are somewhat in line with the environment in rural schools, may partially account for rural students' stable science scores. (SB)

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ED235945

RURAL SCIENCE EDUCATION: BLUEPRINT FOR ALL?

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Paper presented at the Joint Meeting of the Fourth Annual Rural and Small Schools Conference and Kansas Community Education Association Conference, Kansas State University, Manhattan, November 15-16, 1982.

RC014378

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Rural Science Education: Blueprint for All?

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Much interest is currently being expressed about the scientific literacy of the American student.In addition to being the theme of the of the 1982 National Science Teachers Association Convention in Chicago, the scientific literacy issue is pervasive in the science education literature. Although the Reagan Administration has characterized science and math education in the U.S. as being in a "deplorable state", the current focus on problems in science training was prompted by studies initiated by the Carter administration. Indeed, current discussions and debates appear to be outgrowths of criticism leveled at science education which were established from studies initiated by Carter's Department of Education. One study in particular has drawn the attention of the general public and science educators alike creating considerable dialogue. The report, entitled Science and Engineering Education for the 1980's and Beyond was written by then Education Secretary Shirley Hufstedler and D. Langenberg. The authors predicted that..."the current trend toward virtual scientific and technological illiteracy unless reversed, means that important decisions involving science and technology will be made increasingly on the basis of ignorance and misunderstanding."(1980,p.IX) Others have agreed with the dire consequences of the situation. Frank Press, serving as Jimmy Carter's science advisor, now the President of the National Science Foundation stated in 1979, "We would be stupid as a country to permit the continued erosion of science and math training in our primary and secondary schools."(Walsh and Walsh, 1980,p.17)

John Sawhill while serving as Carter's Secretary of Energy stated, "A scientifically literate public is more urgently needed now than ever before."(Sawhill, 1979, p.1) Paul DeHart Hurd, Professor Emeritus at Stanford University, to some the "dean" of science educators in this country, stated his concern in May of 1982 while addressing the National Academy of Sciences. He stated, "A majority of our high school graduates are ...becoming scientifically and technologically illiterate."(Billings Gazette, 1982, p. 6-A)

Concern over the problem of scientific literacy in the U.S. appears to be well founded. First, research shows a decline in the proportion of high school students enrolled in science classes nation-wide.(Jones, 1981; Welch, 1979) This is occurring at a time which science and technology are now, more than ever, an integral part of American life. Evidence of the American students' lack of committment to science was noted recently in a talk given by Francis Collea, head of science education at California State University at Fullerton, "In my son's high school there are 1,800 students and only one physics section." Further, he points out, there is not one full time physics teacher in any Orange County High School.(Rapport, 1981, p. 38)

Second, nationally normed test scores have shown a declining pattern for a decade or more. In general, scores on several nationally normed achievement tests for grades seven through twelve have declined measureably since the mid-1960's. Both the ACT and SAT tests were included in the data of this study.(Jones,1981) These statistics suggest a regretable situation--declining knowledge of science in a dynamic, increasingly technological world.

Yet, a study by Martin in 1979 reports the results of the National Assessment of Educational Progress Test, a highly regarded achievement

test designed to measure knowledge, skills and attitudes of American students at various ages in several learning disciplines and from various demographic categories.(Martin, 1979) Again, science scores nationally reveal declines. But the rural science student has not contributed to the decline. In ten of twelve possible instances of measurement, the rural science student scores have improved when compared to scores nationally. (See Table I)

SCIENCE PERFORMANCE 1969-1977

	1969-70	1972-73	Change	1972-73	1976-77	Change
Age 9						
Nation	61.0	59.8	-1.2	52.3	52.2	-0.1
Extreme Rural	-3.7	-2.6	1.0	-2.2	0.7	2.9
Low Metro	-15.2	-13.4	1.8	-12.0	-11.2	0.8
High Metro	8.1	-6,6	-1.5	5.7	7.3	1.6
Big City	-3.6	-3.5	0.1	-3.6	-4.6	-1.0
Fringes-around Big Cities	4.1	2.8	-1.3	2.5	4.2	1.7
Medium City	1.2	1.3	0.2	2.5	-0.7	-3.2
Smaller Places	-0.1	0.0	0.1	-0.1	0.1	0.2
Age 13						
Nation	60.2	58.5	-1.7	54.5	53.8	-0.7
Extreme Rural	-4.3	-2.0	2.3	-1.9	-0.4	1.6
Low Metro	-11.9	-13.1	-1.2	-10.7	-11.6	-0.8
High Metro	6.4	6.8	0.4	5.4	5.6	0.2
Big City	-3.5	-3.8	-0.3	-3.1	-3.2	-0.1
Finges-around Big Cities	3.1	2.0	-1.1	1.5	2.5	1.0
Medium City	0.8	0.3	-0.5	0.1	-0.1	-0.2
Smaller Places	0.0	0.1	0.1	0.6	0.2	-0.4
Age 17						
Nation	45.2	42.5	-2.8	48.4	46.5	-1.9
Extreme Rural	-2.9	-1.4	1.6	-0.8	-0.3	0.5
Low Metro	-5.1	-7.3	-2.3	-8.1	-10.1	-2.1
High Metro	5.9	4.4	-1.5	4.7	4.4	-0.3
Big City	-1.8	-3.3	-1.5	-3.6	-4.4	-0.8
Fringes-around Big Cities	2.1	1.3	-0.8	1.1	2.5	1.4
Medium City	0.7	-0.1	-0.8	-0.1	0.2	0.3
Smaller Places	-0.5	0.5	1.0	0.8	0.4	-0.4

These data from the National Assessment of Educational Progress Test are particularly interesting in light of certain writings which claim to find rural schools lacking in their ability to provide continuous, high quality education.(Sher, 1977)

What is it that has enabled the rural student to maintain stability in science achievement when students in other demographic settings are not so successful? That which follows is an attempt to shed some light on certain factors which may have influenced this situation. In particular, research was directed toward teacher behaviors which might have had some positive impact on the rural science students' scores.

Considerable research has been reported which speaks to students' attitudes and perceptions of broad based teacher characteristics and behaviors. Studies such as those reported by Bybee and Chaloupka (1971) indicate that students view interpersonal relationships and enthusiasm as the most valued of all teacher behaviors. These views as to the importance of interpersonal relationships are shared by science educators and by the criteria for important teaching awards such as the Outstanding Biology Teacher Award. One reason for the relative success of the rural science students may be tied to the relationship of rural student to rural teacher. Numerous studies have shown that rural schools, because of their small size, promote greater interpersonal communication in student-student and teacher-student relationships.(Barker, Gump, Campbell, Barker, Willems, Friesen, LeCompte and Mikesell, 1962) Often in the rural setting, the school becomes the focal point for community activity, "...allowing teachers, students and parents to develop close, supportive relationships."(Noble, 1981, p. 13) The valued personal

relationships fostered in rural schools should be emphasized where applicable for this behavior may be a major factor in the relative success of the rural science student.

Besides relating to his students the science teacher must exibit teaching behaviors which are effective. Such teaching methods considerations have taken a back seat to interpersonal relationships in terms of stated importance and also educational research. The science education literature is scant regarding the topic of student attitudes toward teaching behaviors, particularly when assessed from a variety of demographic situations. The extent of research in this area suggests that student attitudes toward science instructional processes and procedures vary greatly.(Santiesteban, 1976) In the absence of appropriate existing research, we initiated our own.

By surveying students from a variety of demographic areas with populations considered rural and urban according to definition by criteria described in the National Assessment of Educational Progress Exam, we sought to establish two issues: 1.)Do student perceptions of desireable science teaching behaviors vary according to demographic considerations? 2.) What teaching behaviors of a methodological nature are perceived to be desireable or undesireable by science students in general?

The results of this research lead us to the following conclusions: First, a student's perception of desireable science teaching behaviors is not influenced by the size of the high school the student attends. The data also appear to show that the population characteristics of the area in which the school is located have no critical bearing on perceptions of desireable science teaching behaviors. Rural students appear to have much the same preferences regarding teaching methods as

students from more urban areas.

Second, students do perceive certain teacher behaviors as indicative of quality science teaching and other teaching behaviors as indicative of less than quality science teaching. Again, as stated earlier, these preferences do not appear to vary from students in a rural setting to those in an urban setting. In particular, the students indicated that a teacher who is well prepared to conduct an activity oriented science class with hands-on laboratory experiences in a nearly natural setting(in the field or with natural objects in the classroom) will be perceived as a quality science teacher. On the other hand, a teacher who may appear rigid, vocabulary oriented and inclined to require formal writing will be perceived as a teacher of low quality.

Though students may appear united in their view of quality science teaching methods, actual teaching strategies of science teachers may be quite dissimilar. Preferred teaching styles, financial limitations and logisitical considerations are just a few reasons for divergant teaching strategies from one teacher to another. Yet, a study by Lawrenz(1976) suggests that a student's success in the classroom is influenced by the student's perception of the general classroom environment.

Relative success in the rural science classroom may be tied to the notion that students perceive their rural science classroom environment in a more favorable light that students from other demographic areas. Four of the six methodological behaviors identified by students as indicative of quality science teaching deal with laboratory, field trip, activity oriented methods of science teaching. The rural teacher often has a unique opportunity to implement this type of

instruction. First, class sizes tend to be smaller so that field trips may be more easily implemented. Fewer complications in class scheduling allow the teacher greater flexability in timing field trips.(Colton, 1981) Destination points may require minimal transportation in the rural setting to the extent that students may be able to hike down to the river for a biology investigation or slip out to a nearby field to obtain soil for analysis. Science instructors from other demographic areas more often than not face difficult logisitical barriers in producing activity oriented labs in a natural setting. In summary, it appears that the preferences of science students are rather in tune with the environmental conditions of the rural school to the extent that this union may partially account for the stability and improvement of the rural science students' scores. Rural science teachers need to further exploit this positive advantage of the rural school condition.

The positive trends exibited by rural science students are most likely a combination of factors mentioned thus-far, but a mounting wave of writings suggest that the rural school in general is today, and will be in the future, more appropriately addressing the education of a new societal order. Toffler(The Third Wave, 1980), Schumacher (Small is Beautiful, 1973) and others have addressed the limitations of the "big is better" mentality. These authors contend that there are limits to size, limits to specialization and limits to centralization. These limitations are applied to many systems including educational systems. Toffler(1980) has demonstrated in The Third Wave the onset of a new societal order based on a "demassified society." Nachtigal(1981) has noted that the characteristics of the rural school "coincide fairly closely with those Toffler attributes to a demassified society, ie. small size, a greater degree of interpersonal

communication, minimal beaurocracy, and reduced specialization."(P. 33) Nachtigal also suggests that specialization of instruction in schools has reached the point of diminishing returns and asks, "Is it not better to have teachers who understand the broad structure of their content areas than narrowly prepared technicians?"(p.32)

In essence, it is quite possible, as the previously cited authors have suggested that the rural school is more appropriately equipped to contend with the great changes in education brought about by the profound alteration of society--perhaps the rural science students' success is partially a result of that.

Whatever the reason for the success of the rural science student the appropriate response should not be to dwell on the relatively infant success of this group of students. Rather, rural educators should attempt to exploit those behaviors identified as most effective in contributing to the rural science students' success, ie. the close student-teacher relationships which are so important to students and from a methodological perspective, the hands-on learning experiences in the natural setting. A relative anomaly in a sea of falling science achievement test scores, the rural school has found success in the science classroom.

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